Calling all students!

On digging through an old pile of magazines during the summer, I found a rather old copy of The Beano. Dennis the Menace, his dog Gnasher and friends were offering children the chance to join their new club featuring a free starter pack of "a trendy T-shirt, a colourful giant poster, a practical joke, a credit card torch, a card on your birthday and regular newsletters". Well, the Institute of Physics may not be able to offer you all that for your membership, but the EPG can help you on your way.

Sally Brown with her cat Gnasher (yes, she really is called that!)

Let me introduce myself – I'm not Dennis the Menace, but Sally Brown and I have recently joined the EPG committee. I am a student at Southampton University undertaking a PhD in the School of Civil Engineering and the Environment. My research topic is coastal erosion. It's not quite physics, but its fun to work within the environmental field and apply skills learnt from my physics background. (I did my first degree in Geophysical Sciences at Southampton University). As the youngest committee member, my task is to represent the views of students and encourage participation in EPG events. EPG events cover many topics, so there is sure to be something for everyone. I am looking forward to finding out from students how you would like to be involved and possible events that you would like to see within the EPG.

One example of getting involved is Members' Open Day (it's during the day, so you won't need Dennis's torch!) which will next be held in May 2007 (your free IoP diary is there to note this down, in lieu of the Beano birthday card). Members' Day is an opportunity for all those interested in Environmental Physics to get together and hear about each other's work. On Members' Day 2006 we heard from speakers in industry and academia whose topics ranged from waste recycling to severe weather (see the report in this issue of the Newsletter). At the next Members' Open Day, do come along and find out what is happening in the world of Environmental Physics. Perhaps you have conducted research on your course that you would like to share with other members of the Group, or maybe take the opportunity to participate in the oral or poster presentations. This is where we can really do better than the Beano Club. As we are particularly keen to involve students in the poster presentations, there will be a prize for the best poster. Whether it is a "colourful giant poster" like the Beano's or something a bit more formal, we would really welcome your participation – the prize is not one of Dennis's practical jokes, it's for real! Whether you are an undergraduate or postgraduate student, there is an opportunity to become involved.

If you are attending a conference as part of your course or would like to explore the diversity of Environmental Physics, then Members' Day is a great opportunity to practice those presentation and networking skills in an informal and friendly environment. Bursaries are available for those who need them. Why not attend to see what you have been missing and find out more about Environmental Physics? Can we rival Dennis the Menace? We've covered most of the free gifts the Beano Club has to offer, but I'm struggling a bit with the T-shirt! If you are a student and have any comments or ideas about what you would like to do or see in the future, then please email your suggestions to me (sb20@soton.ac.uk).

2006 Essay Competition

Entries are invited for the second year of the EPG essay competition. The intent is to encourage and recognise excellence in communicating the significance, value and rewarding nature of engaging with environmental physics. Entries should cover any aspect encompassed by the Group's interests in environmental physics, which include, but are not limited to: atmosphere and climate; hydrology; plant physics; waste; energy and the built environment. The target audience should be within the range spanning A-level science students through to Institute members.

- a £500 prize will be awarded to the winning author;
- the winning entries will also be considered for publication in Physics World;
- the competition is open to all, but entries from students are particularly welcome;
- the author of the winning essay may be invited to present a synopsis at the Group's Member's Day meeting in May 2007;
- the closing date is 31st December 2006;
- essays should be up to 2000 words.

Entries must be original and will be judged on writing quality and content. Essays adopting a purely scientific, policy-related or some other perspective will be welcomed.

Entries should be sent to: env.essay@physics.org, preferably as a pdf file, along with full contact details and student status if appropriate. Entries may be also be submitted by post to:

The Chair,
Environmental Physics Group,
c/o The Institute of Physics,
76 Portland Place,
London,
W1B 1NT

Further details are available on the Group's web site.

Peter Hodgson

Environmental Research Letters publishes its first content

The first articles in the new Institute of Physics journal, *Environmental Research Letters* (ERL), were published on 30 October 2006. The early contributions include:

Shifts in plant dominance control carbon-cycle responses to experimental warming and widespread drought by J Harte, S Saleska and T Shih

Images of the energy future by Arthur Mason

Risks of the oil transition by A E Farrell and A R Brandt

Can there be science-based precaution? by Charles Weiss

The Bodélé depression—a single spot in the Sahara that provides most of the mineral dust to the Amazon forest by I Koren, Y J Kaufman, R Washington, M Todd, Y Rudich, V J Martins and D Rosenfeld

All journal content is permanently free to read at http://erl.iop.org

"As a free to read journal, ERL's prime purpose is to serve the entire environmental science community" said Professor Dan Kammen, the Editor-in-Chief for ERL. "I am delighted by the quality of these first contributions and eagerly anticipate the continued growth of this exciting new journal, which for the first time will truly provide a meeting place for the entire environmental community. ERL will be an essential resource for environmental professionals, public officials, academics, and non-governmental groups."

ERL's coverage will reflect the increasingly interdisciplinary nature of environmental science, recognizing wide-ranging contributions to the development of methods, tools and evaluation strategies relevant to the field. Areas of interest and publication will include:

- Biodiversity
- Climate change
- Demographics and the environment
- Energy
- Environmental history and culture
- Environmental and resource economics
- Health
- Policy analysis
- Pollution
- Science and politics of environmental risk assessment
- Science and practice of sustainability

The ERL Editorial Board would like to invite article submissions from all researchers working at the forefront of environmental science. Full details about the article submission process and editorial criteria may be found at http://erl.iop.org. All queries regarding ERL can be directed to the journal team at erl@iop.org.

Forthcoming Events

Climate Change, the Environment and YOU

The University of Sussex , Saturday 18th November 2006

Speakers and talks to include:

Professor Michael Boulter, Natural History Museum:*A History of Climate Change*

Dr Paul Williams, University of Reading: *The Gulf Stream Switch-off*

Claudia Chambers, Natural England: *Climate Change and Biodiversity*

Dr Jim Watson, SPRU – Science and Technology Policy Research, University of Sussex: *Micro-generation: generating energy in the home*

Professor Kate Soper, London Metropolitan University: *Beyond Consumerism: self-interest,pleasure and sustainable consumption*

Dr Esteve Corbera, Tyndall Centre for Climate Change Research, University of East Anglia: *Climate Change: a risk or an opportunity or sustainable development in poor countries?*

Contact: CCE Open Lecture Enrolments
The Sussex Institute, University of Sussex
Falmer, Brighton BN1 9QQ
T 01273 877888
F 01273 877534
E si-enquiries@sussex.ac.uk
http://www.sussex.ac.uk/cce

The Institute of Physics Environmental Physics Group and The

Aerosol Society

Condensation processes

Dublin, 28th Feb 2007

Dr Colin O`Dowd, National University of Ireland, Galway: *Condensation, Atmospheric Aerosol Growth, and Climate Impacts*

Dr Tony Scott, University College Dublin: *The development and evolution of the condensation nucleus counter*

Dr Ian Ford, University College London: *Nucleation theory at the microscopic scale*

Speaker TBC: *Aerosol cloud interactions*

Speaker TBC: A*ircraft contrails*

Dr Giles Harrison, University of Reading: *Surface observations of cloud changes associated with cosmic rays*

Chair: Dr Frank McGovern Irish EPA

Contact Pat Goodman for further information.

Oceans of Technology

Aberdeen, 18-21 June 2007

Our oceans present a complex and diverse environment providing us with a vast resource which plays a major role and impacts on all our lives. Indeed, the oceans cover over 70% of the planet's surface, 80% of all life on earth is found in the oceans, and yet 90% of the ocean floor has yet to be explored. No wonder that our marine, subsea, and oceanic engineers never tire of the challenges that such rich diversity brings.

It is without doubt that technology has played, and will continue to play a very important role in probing the ever extending frontiers of our knowledge of the oceans. Our very earliest ocean navigators explored their understanding of the winds, currents, and oceanography. Yet it is only in very recent history (1960) that man explored the deepest part of the ocean; and it was the technology embedded in the manned submersible the *Trieste* that took man over 10,000 metres down to the bottom of the Mariana Trench. Now underwater technology is moving forward in strides with an increasing sophistication as we combine computing power, imaging systems, and modern communications and equipment to better understand this vast global environment.

Our ocean scientists and engineers are now seeking new horizons as they tackle challenges as diverse as new treatments for diseases (including cancer) and the impact of energy on our climate. In doing so, new technologies are emerging all the time. New hybrid remotely operated and autonomous underwater vehicles are being developed to penetrate the most remote regions of our oceans. The development of underwater acoustic, digital, and holographic imaging allows our improved resolution of areas never before seen. Better manoeuvrability of underwater vehicles and increasing complexity and reliability of manipulative equipment allows more controlled collection of ocean samples for laboratory research.

The oceans offer a wealth of resources that would not be available without the technology to exploit them. Precious minerals such as diamonds always provide a strong incentive for underwater exploration. Many diamonds have been recovered offshore South Africa using technology developed in other areas of ocean research, and areas off the Australian coast are resorting back to the principles of physics coupled with modern positioning technologies. The offshore oil and gas industry has driven many advances in underwater technology in our quest for 'black gold'. The first offshore oil was recovered in shallow water near the coastline, but as our shallow water discoveries begin to diminish exploration moves in to deep waters.

Whether we recognise it or not the oceans play a major role in our lives and equally human activities on a global level have, and will continue to have, an impact on conservation of the ocean resources and our future economic viability. From coastline to deep sea the oceans provide our marine, subsea, and oceanic engineers with many challenges in their drive to understand the complexities of the world's oceans, and all that this diverse environment holds for us.

Whilst exploiting the oceans' resources it behoves us to foster their protection in a sustainable manner. As part of this process, *Oceans '07* aims to bring together the more experienced players with the new and developing young skills to foster the continuing allure, exploitation, and necessary protection of this environment.

Oceans '07 is a major international event and is being run under the auspices of the *Oceanic Engineering Society* (OES) and its parent organisation *The Institute of Electrical and Electronic Engineers* (IEEE). This prestigious "*Oceans"* conference and exhibition is being held in association with The University of Aberdeen with major support from Subsea UK, BP, Aberdeen City Council, Fugro, Shell, Kongsberg and the Office of Naval Research. This is the first time that this event has been held in the UK and only the second time in Europe.

The long-established worldwide pedigree of *Oceans* will make Aberdeen, Scotland the focus for many leading international industrialists and academics in 2007 and our remit is to promote and disseminate knowledge, understanding and awareness of all the engineering, science, and technology of the oceans and its impact on our lives and environment.

"***Marine Challenges: Coastline to Deep Sea***" is the *Oceans '07* theme and will highlight the significant challenges facing marine, subsea, and oceanic engineers in their drive to understand the complexities of the world's oceans. These challenges start from the shallowest waters around our coastlines and stretch to the deepest subsea trenches and cover not only science, technology and subsea exploration, but also preservation and sustainability, extraction and protection of resources (mineral and natural), policy and education, and finance and funding.

We expect a host of international speakers to address the "Challenges" theme, and to fill a wide-ranging technical programme and exhibition. If you would like to play your part in this event, we invite the world's marine policy makers, ocean scientists, subsea engineers, and technologists to come to Aberdeen, Scotland on 18-21 June 2007 to present and discuss the challenges for the future. Have a look at our website for more details www.oceans07ieeeaberdeen.org

We promise to give you a traditional Scottish welcome that will leave you wanting more.

Meeting Reports

Members' Day
10th May 2006, Institute of Physics, London

The Members' Day meeting is becoming a regular feature of the EPG events calendar. This year's event largely followed the format of previous years, the focal point being a series of talks offered by members, on a disparate range of topics reflecting the wide interests of the EPG. This year, the meeting also hosted the culmination of the inaugural EPG essay competition, including the presentation of prizes and talks by the winners.

The meeting began with an invited presentation, given by Ross Reynolds of Reading University. He gave a fascinating talk on extreme weather events, specifically tornados, on how they form and evolve. It was interesting to hear, sitting in London, that there are more tornados per unit area in the south-east of England than in Oklahoma. Mr Reynolds revealed how the large scale weather environment is critical for the formation of tornados and how recent efforts in the US have improved the prediction time from 5 to 15 minutes, leading to much improved safety of those in the path of a tornado.

Derek Rose then provided some insight into the problems of salinity levels in agricultural soils, particularly in semi-arid and arid locations. In many cases, irrigation results in a rise in the water table, to close to the surface, which can result in soil degradation and a reduction in crop yield. The concept of dry drainage was presented as a sustainable technique to ameliorate soil condition in problem areas.

Phillip Bland finished off the morning talks, with a presentation on waste electronic equipment (WEEE). He started with some alarming statistics on the quantity of this type of waste and how new regulations are coming into force to deal with it. The composition of the plastic waste was outlined and technical developments on how to identify, separate and reprocess it were described. To round off, a vision of what future recycling plants might look like was presented.

Finally, Tim Smith introduced Environmental Research Letters, a new open access journal from IoP Publishing that is now inviting submissions (see item in this Newsletter).

The afternoon session began with a prize presentation to the essay competition winners, Emma Turner (2nd prize) and Sally Brown (1st prize). (The 3rd prize winner Jennifer McClure, who wrote about the Northern Lights, was unfortunately unable to attend due to examinations at Liverpool University.) Emma Turner of Imperial College spoke on the subject of her essay, "Ice cores and Milankovich". This focused on the possible modulation of climate by three types of tiny variation in Earth's orbital motion, caused by, for example, gravitational forces from other planets. Changes in climate over the last six hundred and fifty thousand years correlate with periodic variations in carbon dioxide concentrations, which in turn are closely related to the Milankovich cycles. Ms Turner described her spectral analysis of a long time

series of June solar radiation, in which two of the three major Milankovich signals could be seen. However, ice core analysis shows that there were climate signals from all of the three forms of orbital variation. The reasons for the signal not appearing in the solar radiation are uncertain. Ms Turner explained that the availability of a new period of ice core data might help to resolve this issue.

The final talk of the afternoon was given by Sally Brown on her winning essay, which was related to her PhD on the management of coastal erosion. Not many speakers at the Institute of Physics own up to being inspired by an article in the Daily Mail, but this one began entertainingly with a description of the problems faced by a teashop at Happisburgh, Norfolk, at which the sea views get better every day (www.happisburgh.org.uk). The soft rock on the east side of the UK means coastal erosion is a widespread problem. Shoreline management is the difficult job of deciding whether it is economic or effective to even start to fight the battle of defending the coast from the sea. Examples of sea defences such as groynes can be seen at Barton-on-Sea in Hampshire or Hornsea in Yorkshire. The alternative approach, as at Happisburgh, is just to leave a settlement to fall into the sea. In a lively and interesting presentation, Ms Brown outlined the difficult decisions faced by those working in shoreline management and the interplay between scientific fact and more human factors.

Essay competition 2nd prizewinner Emma Turner receives her prize cheque from Alastair McCartney, at his last meeting as Group Chair.

Peter Hodgson / Karen Aplin

Environmental Electrostatics 2
5th July 2006, Institute of Physics, London

The motivation for this half-day conference on past and present measurements in environmental electrostatics was the centenary of a paper published by C.T.R.Wilson, which described an instrument to measure the small electric current flowing vertically between the positively charged ionosphere and the earth's surface. The measurements initiated by Wilson were continued by the UK Met Office at Kew from 1909-1979. The meeting was hosted jointly by the Electrostatics Group and the Environmental Physics Group. The conference was well attended and proved a great success, providing an interesting and valuable commentary on how research in this field has progressed over the years to the current day. Mr Andrew Wilson, the grandson of CTR and himself a physics graduate attended the meeting and brought along a fascinating display of personal artefacts that had been kept in the family for the fifty years since CTR's death.

The presentations started with meeting organiser Giles Harrison (University of Reading) on *Influences on atmospheric electricity: insights from measurements spanning four centuries*. This talk took an historical perspective. Fossil evidence exists for lightning 250 million years ago, but it was not until the 18th century that both thunderstorms and non-storm clouds were shown to be electrified. A positive potential gradient (PG), by convention, the negative electric field, in fair weather was established in the 1750s.

By the 19th Century, the PG was found to have a repeatable diurnal cycle with two daily maximum peaks in urban air. From 1845-1847, measurements of PG were taken every 2 hours at Kew Observatory, by Sir Francis Ronalds. Kelvin worked out an improved method of recording using a water dropper and mechanical electrometer with autographic recording. In the 1890s the Eiffel Tower was used for research employing a Kelvin water dropper, again showing a diurnal cycle. The French work has been re-evaluated with modern electrostatic modelling software, allowing calibration of the measurements. Above the surface and tower measurements, balloon carried sensors were used. In the 1890s Joseph Tuma demonstrated that the magnitude of potential gradient falls with height. Further developments, such as Gerdien's condenser, allowed air conductivity to be measured simultaneously with potential gradient.

The conceptual framework for the global atmospheric electric current concept was developed by C.T.R Wilson. In summary the potential gradient is typically 120 Vm^{-1} at 1 metre above the surface, and the electrical conductivity of the air (5-30 fSm^{-1}) is increased by ion production and reduced by aerosol removal of ions. The global picture was principally established by the Carnegie voyage measurements of conductivity and potential gradient (1915-1929).

Alec Bennett (University of Reading) gave a talk on *Modern measurements of the air-earth current*, initially discussing how the global atmospheric electric circuit results from charge separation and then documenting the four different current components (conduction current, displacement current, turbulent current, precipitation current) required to undertake horizontal plate collection. The Kew (Wilson) dataset is thought to be the longest and most reliable record of conduction current measurements. Mr

Bennett described his development of a geometrical method to measure the air-earth current density. This involved making a pyramid using $2m^2$ of metal with a $1m^2$ cross-section, in a $1m^3$ hole at the observatory site. Considerable technical challenges were overcome, for instance the absorption of water by PTFE electrodes, to monitor the global circuit current.

Karen Aplin (Rutherford Appleton Laboratory) spoke on *Modern methods of air conductivity and atmospheric cluster ion measurements*. The principles of the Gerdien condenser were discussed, developed to include switched bias voltages for mobility selection. Using a modern version of this instrument, experiments have begun to search for IR absorption bands from charged clusters in Earth's atmosphere, already known to exist in the laboratory environment.

In *Electric field sensors for long term measurements,* John Chubb (John Chubb Instrumentation) discussed the measurement principles of the electric field mill. In environmental measurements, water, debris, insects cause problems. These are not solved by field mill pointing downwards, as wind will blow droplets upwards. The new JCI 131 field mill features a fast sampling rate which permits measuring the combination of atmospheric +50/60Hz ac fields and dc fields, *e.g*. near high voltage power lines, and ingenious grounding requirements prolong the instrument's lifetime.

The final talk of the meeting was given by William Ingram (Met Office) on *The air-earth current and air conductivity measured by C.T.R. Wilson's methods*. The UK atmospheric electricity measurement observation of surface potential gradient began in 1843 and Kelvin later installed his water dropper apparatus in 1861. Two further observation sites were established by the Met Office at Eskdalemuir (1908) and Lerwick 1926). In 1906 Wilson's instrument provided a new technique to measure air earth current density. The dataset, obtained at Kew Observatory, 1909-1979 at 1430 GMT on fine days (about half the time) provides a unique resource for studies of long-term geophysical change and the effect of air pollution. There was a data gap in measurements of potential gradient from 1949-1956, and during the nuclear weapons test period (1956-1965), the current density greatly increased because of surface radioactive contamination. Mr Ingram also asked whether suitable data existed to investigate the suggested links between air ions, clouds, dusts and the atmospheric electric circuit. Electrical effects on ice cloud are poorly known, but water cloud physics better understood. Charge may make a difference in ultrafine condensation nuclei formation, but may not have a significant effect on cloud condensation nuclei. Mr Ingram indicated that the correlation between cosmic rays and cloud cover suggested by some scientists may actually not exist, as when less highly-processed data is used for analysis no signal is apparent.

Keith Jamieson, Imperial College

Optical Environmental Sensing
6th September 2006, Manchester

The fourth in the series of Optical Environmental Sensing meetings, organised by the Optical and Environmental Physics Groups of the Institute of Physics, this year formed one of the sessions at the biennial Photon06 optics conference. A dozen speakers offered a stimulating set of talks on optical techniques applied to environmental problems, to an audience of over forty people.

LIDAR provided the early focus for the meeting, Professor Geraint Vaughan of the University of Manchester opening proceedings with an excellent review. Subsequent papers explored applications of LIDAR, including monitoring of the atmospheric boundary layer and aircraft emissions. Indeed, engine emissions proved to be a recurring theme throughout the meeting. The dispersion and evolution of pollution plumes were described in the context of environmental pressures on residential areas close to airports. A further talk homed in on the measurement of unburnt hydrocarbons, whilst Moira Hilton, of the University of Reading, provided a summary of the state of the art in FTIR measurements applied to aeroengine exhaust emissions.

More applications-oriented talks at the meeting described the characterisation of biological airborne particles using fluorescence and elastic light scattering techniques and an inverse method to locate a gas source for oil prospecting. Other papers discussed the application of new optical technology developments, including quantum cascade lasers and photonic crystal fibres, to environmental measurements.

Once again, OES was an interesting, high quality and well attended meeting. The purpose, of supporting the community engaged in using optical techniques for environmental sensing, will continue with the 5th OES planned for October 2007.

Peter Hodgson

News

Congratulations

Professor Mike Lockwood (Rutherford Appleton Laboratory/Southampton University), the 2003 Chree Medallist, has been elected a Fellow of the Royal Society. Fellows are elected for their contributions to science, both in fundamental research resulting in greater understanding, and also in leading and directing scientific and technological progress in industry and research establishments. A maximum of forty-four new Fellows, who must be citizens or residents of Commonwealth countries or Ireland, may be elected annually.

On hearing the news, Professor Lockwood said, "I am genuinely delighted and honoured. I must give credit to all my colleagues at RAL and to my family who have given me fantastic support throughout my career. I'd also like to acknowledge a wonderful schoolteacher, Len Goldsmith, who made physics fascinating and, as we would say back then in the sixties, 'cool' - he made me want to pursue science as a profession."

Call for Applied Physics Division Student Prize Nominations

Did you know that the Environmental Physics Group is a member of the Applied Physics Division? The Division has a prize which it awards annually to a student who has made an outstanding contribution to a Group within the Division. If you know of a student who may be eligible, please send a short case in support of the student to Karen Aplin, the Divisional Representative.

EPG Travel Bursaries

Travel Bursaries are usually available for Group members in financial need to attend meetings. Please contact Peter Hodgson for further information.

Institute of Physics Benevolent Fund

The primary aim of the Benevolent Fund is to provide members of the Institute of Physics or their dependents facing a critical need that cannot otherwise be met, with assistance that will help improve their prospects of continuing to lead a fulfilling life.

The category of people we can help

* Members or their families in need due to disability, illness death or unforeseen problems.
* Members facing critical career issues.
* Members facing problems in employment.

* Students of physics facing hardship through illness, disability or other unforeseen problems.

The principal beneficiary will be the members of the Institute of Physics and members of IPEM, however, in exceptional circumstances help can be provided to those who are not in membership.

If you would like further details or if you feel you might meet these criteria, or know someone else who might, please contact me at the following address: Mrs Susan Dowling, Secretary of the Benevolent Fund, Crosswinds, Grovehurst Road, Iwade, Kent, ME9 8RE or email suemdowling@yahoo.co.uk

Any correspondence will of course, be treated as confidential.

Committee Changes

At the AGM held in May 2006 there were some changes to the Committee. Alastair McCartney is no longer Chair of the group and has been replaced by Peter Hodgson. Giles Harrison is now Vice Chair and Pat Goodman is Secretary. We are also pleased to welcome Sally Brown as a co-opted committee member. The mean age of the Committee is 43±19 years (this is not currently a compulsory statistic required by the Institute, but, as ever, we choose to be prepared).

EPG Committee

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